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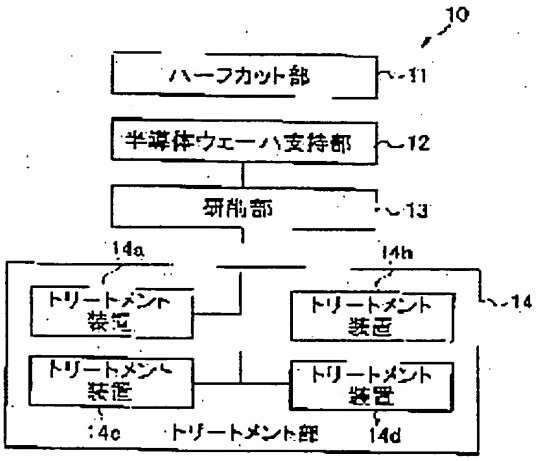
(54) SEMICONDUCTOR WAFER DIVIDING SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To efficiently remove grinding marks and a grinding-strained layer, without deteriorating the productivity on the whole, in the so-called 'pre-dicing' which forms kerfs not reaching the backside into the surface of a semiconductor wafer and grinds the backside to expose the kerfs on the surface, thereby dividing into individual semiconductor chips.
SOLUTION: The semiconductor wafer dividing system comprises at least a half cutter 11 for forming kerfs which do not reach the backside into streets formed on the surface of a semiconductor wafer, a semiconductor wafer holder 12 for supporting the surface of the wafer having the formed kerfs with a support tray, a grinder 13 for grinding the backside of the wafer by a specified quantity and a treatment block 14 for treating the ground backside of the semiconductor wafer. The treatment block 14 comprises a number of treatment units which correspond to the throughput of the grinder.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the semiconductor wafer division system divided into each semiconductor chip by carrying out grinding of the rear face and making a cut slot express, after forming the cut slot which is not penetrated to a rear face on the surface of a semiconductor wafer.
[0002]
[Description of the Prior Art] After forming the comparatively shallow cut slot which is not penetrated to a rear face in the street which divides two or more semiconductor circuits formed on the surface of the semiconductor wafer as a technique for forming a semiconductor chip thinly, the technique called the point dicing which is made to express a cut slot from a rear-face side, and is divided into each semiconductor chip is developed by these people etc. by carrying out grinding of the rear face of the semiconductor wafer.
[0003] Since it also becomes possible to process it so that the thickness of a chip may be set to 100 micrometers or less according to this point dicing technique, the demand of the miniaturization of various devices, such as a portable telephone, and thin-shape-izing can be met.
[0004] However, since a grinding distortion layer with a thickness of about 0.1-10 micrometers is formed in the interior of it while grinding marks are formed in the rear face of a semiconductor chip of the grinding of the rear face of a semiconductor wafer, the anti-chip box reinforcement of each semiconductor chip falls, and there is a problem of becoming easy to damage.
[0005] Then, the treatment equipment which performs chemical etching etc. is incorporated in grinding attachment, treatment processing of the rear face of each semiconductor chip after grinding is carried out within grinding attachment, grinding marks and a grinding distortion layer are removed, and the device of raising anti-chip box reinforcement is also made.
[0006]
[Problem(s) to be Solved by the Invention] However, since the amount of grinding of the rear face of a semiconductor wafer and the amount removed by treatment processing change with the class of semiconductor wafer, or users, when grinding capacity and treatment capacity cannot be balanced, it has the problem that productivity falls remarkably.
[0007] For example, in a certain grinding attachment, grinding capacity is ten per unit time amount, and when treatment capacity is two per unit time amount concerned, production capacity drops to 1/5 substantially.
[0008] Thus, it has the technical problem to perform treatment processing efficiently, without reducing the whole productivity, when requiring a treatment after grinding.
[0009]
[Means for Solving the Problem] As a concrete means for solving the above-mentioned technical problem, this invention It is the division system of the semiconductor wafer which divides into each semiconductor chip the semiconductor wafer with which two or more semiconductor circuits were divided and formed of the street for every semiconductor circuit. The half cutting section which forms the cut slot which is not penetrated to a rear face in the street formed on the surface of the semiconductor wafer, The semiconductor wafer supporter which makes a support tray support the front face of a semiconductor wafer in which the cut slot was formed, The grinding section which

carries out requirements grinding of the rear face of a semiconductor wafer, and the treatment section which carries out treatment processing of the rear face of a semiconductor wafer [finishing / grinding] are included at least. The treatment section offers the division system of the semiconductor wafer characterized by consisting of treatment equipment of the number corresponding to the throughput of the grinding section.

[0010] And the division system of this semiconductor wafer makes it additional requirements to consist of a frame which has opening in the center, and a tape which plugs up opening, for the semiconductor wafer supported by that a semiconductor wafer is supported on a tape in opening and the support tray to be held by the cassette, to be conveyed by the grinding section, to hold a semiconductor chip or a semiconductor wafer in a cassette, and for a support tray to be conveyed by the treatment section. [finishing / grinding]

[0011] Thus, since the division system of the semiconductor wafer constituted was made to correspond to the throughput of the grinding section and constituted the treatment section, it can balance the grinding capacity of the grinding section, and the treatment capacity of the treatment section, and can perform processing to a treatment most efficiently by this.

[0012]

[Embodiment of the Invention] As an example of the gestalt of operation of this invention, the division system 10 of the semiconductor wafer of a configuration of being shown in drawing 1 is explained. The division system 10 of this semiconductor wafer consists of the half cutting section 11, a semiconductor wafer supporter 12, the grinding section 13, and the treatment section 14.

[0013] A cut slot is formed in the front face of semiconductor wafer W shown, for example in drawing 2 R> 2 in the half cutting section 11. This semiconductor wafer W has the composition that the semiconductor circuit C by which two or more formation was carried out was divided by Street S on the front face, and the cut slot which is not penetrated to a rear face is formed in Street S using the dicing equipment 20 shown in drawing 3 which constitutes the half cutting section 11 (half cutting is carried out).

[0014] In the dicing equipment 20 of drawing 3 , two or more hold is carried out at a cassette 21, after one semiconductor wafer W which is going to carry out half cutting is taken out at a time by the taking-out acquisition stage 22 to the temporary placing field 23, by the first conveyance means 24, it is conveyed by the chuck table 25 and attraction maintenance of it is carried out.

[0015] Next, when the chuck table 25 moves in the direction of +X, semiconductor wafer W is positioned directly under the alignment means 26, the street which should form a cut slot here is detected, and alignment of Y shaft orientations of the street and revolution blade 27 is performed.

[0016] And the cut means 28 which the chuck table 25 holding semiconductor wafer W moved in the direction of +X further, and was equipped with the revolution blade 27 which carries out a high-speed revolution descends, and it cuts deeply on the street of the front face of semiconductor wafer W. At this time, a cut slot is formed in a front face by cutting deeply so that the point of the revolution blade 27 may not reach to a rear face, and controlling and cutting the depth.

[0017] moreover, while only street spacing deduces and carries out delivery of the cut means 28 to Y shaft orientations, the cut slot of the depth of about 1 law is formed in all the streets of this direction by making X shaft orientations carry out both-way migration of the chuck table 25.

[0018] Furthermore, by performing the same cut as the above, since the chuck table 25 is rotated 90 degrees, as shown in drawing 4 , the cut slot 29 slightly deeper than the result thickness of a chip is formed in all the streets prepared in all directions.

[0019] Next, the support tray 30 is made to support semiconductor wafer W by which the cut slot 29 was formed in the front face in the semiconductor wafer supporter 12, as shown in drawing 5 and drawing 6 . It consists of tapes 33 which this support tray 30 is stuck on the frame 32 of the shape of a ring which has opening 31 in the center, and the rear face of a frame 32, and plug up opening 31, and by sticking the front face of semiconductor wafer W on the adhesive face of a tape 33, as shown in drawing 5 and drawing 6 , semiconductor wafer W by which half cutting was carried out is supported united with the support tray 30.

[0020] Semiconductor wafer W is made to unite with the support tray 30 like drawing 5 and drawing 6 in the semiconductor wafer supporter 12 using tape attachment equipment 35 as shown, for example in drawing 7 (A) and (B). First, a rear face is turned up, a frame 32 is laid in the installation

base 36 of tape attachment equipment 35, a front face is further turned to the opening 31 up, and semiconductor wafer W is laid. And rotating a cutter 38, as are shown in drawing 7 (A), and a tape 33 is simultaneously stuck on a frame 32 and semiconductor wafer W using a roller 37, next it is shown in drawing 7 (B), adhesive tape 33 is applied to the rear face of a frame 32, and is cut circularly.

[0021] In this way, semiconductor wafer W supported by the support tray 30 is conveyed by the grinding section 13. In the grinding section 13, after having been supported by the support tray 30 using the grinding attachment 40 shown, for example in drawing 8 , grinding of the rear face of semiconductor wafer W is carried out.

[0022] In this grinding attachment 40, semiconductor wafer W [finishing / half cutting] supported by the support tray 30 turns a rear face up, and is held in cassette 41a. And one sheet is taken out at a time by the taking-out acquisition stage 42, it is laid in the main doubling table 43, and alignment is carried out to a fixed location.

[0023] It is supporting four chuck tables 45, 46, 47, and 48 possible [rotation], and can position the chuck tables 45, 46, 47, and 48 in a necessary location by revolution of a turntable 44 while the turntable 44 has pivotable self.

[0024] Semiconductor wafer W by which alignment was carried out in the main doubling table 43 is conveyed by the chuck table 45 with the first conveyance means 49. And when a turntable 44 rotates 90 degrees in the counterclockwise direction, semiconductor wafer W is positioned directly under the first grinding means 50.

[0025] Here, the first grinding means 50 is supported by the supporter 54 which is guided to the guide rail 52 of the couple perpendicularly arranged by the wall 51, and moves up and down by actuation of a driving source 53, and has composition which moves up and down with vertical movement of a supporter 54. In this first grinding means 50, it is equipped with the grinding stone 57 at the head of the spindle 55 supported pivotable through the mounter 56. This grinding stone 57 has composition which the grinding stone piece 59 for rough grinding fixed in a circle in the lower part of the wheel pedestal 58, as shown in drawing 9 .

[0026] On the other hand, the second grinding means 60 is supported by the supporter 63 which is guided to the guide rail 61 of the couple perpendicularly arranged by the wall 51, and moves up and down by actuation of a driving source 62, and has composition which moves up and down with vertical movement of a supporter 63. In this second grinding means 60, it is equipped with the grinding stone 66 at the head of the spindle 64 supported pivotable through the mounter 65. This grinding stone 66 has composition which the grinding stone piece 68 for finish grinding fixed in a circle in the lower part of the wheel pedestal 67, as shown in drawing 9 .

[0027] When the first grinding means 50 descends with the revolution of a spindle 55 and the rotating grinding stone piece 59 contacts a rear face, rough grinding of the rear face of semiconductor wafer W positioned directly under the first grinding means 50 is carried out. And grinding is carried out, until the cut slot 29 expresses here, or until just before expressing. It is divided into each semiconductor chip when the cut slot 29 is made to express.

[0028] Next, a turntable 44 rotates 90 degrees in the counterclockwise direction, and semiconductor wafer W is positioned directly under the second grinding means 60. And finish grinding is performed, when the second grinding means 60 descends with the revolution of a spindle 64 and the rotating grinding stone piece 68 contacts a rear face. When the cut slot 29 is not made to express at the time of rough grinding, the cut slot 29 usually expresses for the first time here, and it is divided into a semiconductor chip, but in making it express for the first time by the treatment processing explained later, until just before expressing here, it carries out grinding. For example, when the cut slot 29 expresses, as shown in drawing 10 , it is divided into each semiconductor chip C by the cut slot 29, and each semiconductor chip C is in the condition [being supported at the support tray 30].

[0029] In this way, when a turntable 44 rotates 90 degrees, each semiconductor chip formed of grinding on the back is positioned in the location of the chuck table 46 in drawing 8 , and is conveyed by the washing means 70 with the second conveyance means 69 in the condition [being supported on the support tray 30]. And after grinding waste is removed by washing, the taking-out acquisition stage 42 holds in cassette 41b.

[0030] Cassette 41b in which the semiconductor chip supported by the support tray 30 was held is

conveyed by the treatment section 14 next. As shown in drawing 1 , the treatment section 14 is equipped with two or more treatment equipments. In the example of drawing 1 , it has four treatment equipments 14a, 14b, 14c, and 14d.

[0031] The number of treatment equipment is made to correspond to the grinding capacity in the grinding section 13, and is adjusted. For example, when the time amount taken to carry out grinding of the semiconductor wafer of one sheet in the grinding section 13 is 2 minutes and the time amount taken to carry out the treatment of the semiconductor wafer in treatment equipment is 10 minutes, five treatment equipments are installed and each performs treatment processing in parallel.

[0032] When the time amount taken to carry out grinding of the semiconductor wafer of one sheet in the grinding section 13 on the other hand is 10 minutes and the time amount taken to carry out the treatment of the semiconductor wafer in treatment equipment is 2 minutes, five grinding attachment is installed in the grinding section 13, and only one set is installed in the treatment section 14 in treatment equipment. And treatment processing of the semiconductor wafer by which grinding was carried out in five grinding attachment can be efficiently carried out with one treatment equipment.

[0033] The dry etching system 80 shown in drawing 11 which performs dry etching, for example to the rear face (grinding side) of a semiconductor chip as treatment equipments 14a, 14b, 14c, and 14d can be used.

[0034] The taking-out close chamber 81 to which this dry etching system 80 performs the taking-out close of a tabular object, It has the processing chamber 82 which performs dry etching, and the gas supply section 83 which supplies etching gas to the processing chamber 82. Each semiconductor chip conveyed from the grinding section 13 is held in cassette 41b, one sheet is taken out at a time by the taking-out acquisition stage 84, and the first gate 85 is held in the taking-out close chamber 81 by open Lycium chinense.

[0035] If explanation is continued with reference to drawing 12 and a semiconductor chip will be held in the taking-out close chamber 81, the interior of closing and the taking-out close chamber 81 will be made into a vacuum for the gate 85. Next, when an aperture and an attaching part 86 move the second gate 87 established in the processing chamber 82 to the interior of the processing chamber 82, semiconductor wafer W [finishing / division] is held in the processing chamber 82. And the second gate 87 is closed and the interior of the processing chamber 82 is sealed.

[0036] As shown in drawing 13 , the gas supply section 83 is equipped with tank 88a in which etching gas, such as a nitric acid and a hydrofluoric acid, is stored. While having composition which supplies etching gas to the processing chamber 82 through a hose 89 with a pump 88 and supplying cooling water to the cooling section 92 from the cooling water circulatory organ 93 Dry etching of the rear face of semiconductor chip C is carried out by supplying high-frequency voltage to RF electrodes 91a and 91b of a couple from the RF generator prepared in the processing chamber 82, and the alignment machine 90, supplying etching gas, where the processing chamber 82 is sealed. In addition, when grinding is not performed until the cut slot 29 expresses in the grinding section 13, the cut slot 29 expresses for the first time by this dry etching, and it is divided into each semiconductor chip C.

[0037] Thus, if dry etching is performed, each grinding marks and grinding distortion layer of a grinding side of semiconductor chip C will be removed.

[0038] The gas supply section 83 is equipped with the processing chamber 82, the suction pump 94 open for free passage, and the filter 95, after termination of etching, it is drawn in with a suction pump 94, it is further neutralized in a filter 95, and etching gas is discharged outside from the blowdown section 96. And the attaching part 86 which made the inside of the processing chamber 82 the vacuum, and held semiconductor wafer W [finishing / an aperture and the etched division of the second gate 87] moves to the taking-out close chamber 81, and closes the second gate 87.

[0039] In this way, if semiconductor wafer W moves to the taking-out close chamber 81, an aperture and the taking-out acquisition stage 84 will hold semiconductor wafer W, will take out the first gate 85 from the taking-out close chamber 81, and will hold it in cassette 41b shown in drawing 11 .

[0040] In addition, as treatment equipment, other equipments from which the grinding marks and the grinding distortion layers other than a dry etching system 80, such as a wet etch station, polishing equipment, and felt grinding stone equipment, are removable can also be used.

[0041] For example, it sets to the wet etch station 100 as shown in drawing 14 . Drive the

maintenance table 101 on which semiconductor wafer W is held to an actuator 102, and it has become pivotable. Turn a rear face upwards and the semiconductor chip supported by the support tray 30 is held in the maintenance table 101. By dropping an etching reagent at the rear face of semiconductor chip C (or semiconductor wafer [before being divided] W) from the dropping section 103, specified quantity etching of the rear-face whole surface is carried out, rotating the maintenance table 101. And like the case of dry etching, the grinding side of each semiconductor chip is etched and the grinding marks and the grinding distortion layer of the grinding side concerned are removed.

[0042] Thus, by having been made to carry out specified quantity clearance of the rear face by chemical etching, just before being divided after division of a semiconductor wafer or into a semiconductor wafer, grinding marks and a grinding distortion layer on the back are removed, and anti-chip box reinforcement becomes high.

[0043] After grinding marks and a grinding distortion layer are removed, it is conveyed to the process which makes each semiconductor chip secede from the support tray 30. Although the equipment which pulls up the support tray 30 and is made to secede from the support tray 30 is used since a tape is stuck on the rear face of the etched semiconductor chip in this process and the support tray 30, semiconductor chip C, and the stuck tape are reversed, it is the relation between the throughput of this equipment, and the throughput of treatment equipment, and it is also possible to adjust the number of treatment equipment.

[0044] In addition, when treatment equipment is an etching system, as for the support tray 30, it is desirable to constitute from construction material which is not etched with etching reagents, such as a nitric acid, a hydrofluoric acid, a potassium hydroxide, and a sodium hydroxide,, either, for example, polypropylene.

[0045]

[Effect of the Invention] Since the grinding capacity of the grinding section and the treatment capacity of the treatment section can be balanced since according to the division system of the semiconductor wafer concerning this invention it was made to correspond to the throughput of the grinding section and the treatment section was constituted as explained above, and this can perform processing to a treatment most efficiently, productivity can be improved as a whole. And since it was made to convey in the treatment section after having been supported by the support tray while the semiconductor wafer carried out grinding of the rear face of the semiconductor wafer in the condition of having been supported on the support tray, also after being divided into a semiconductor chip by grinding, where the configuration of a semiconductor wafer is maintained, it can convey in the treatment section from the grinding section per semiconductor wafer.

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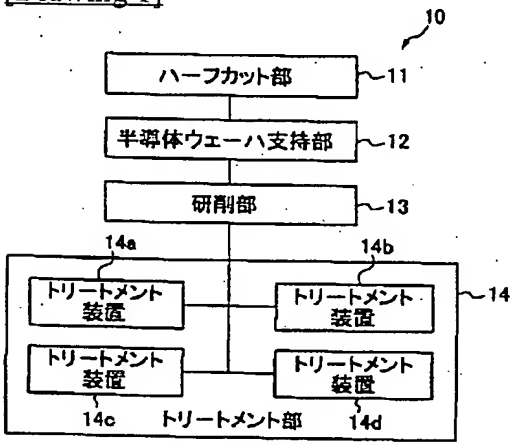
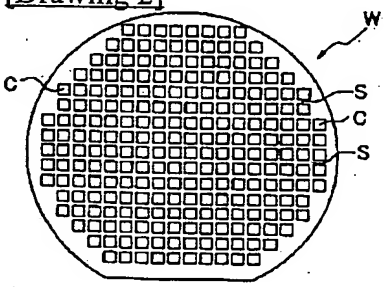
DRAWINGS

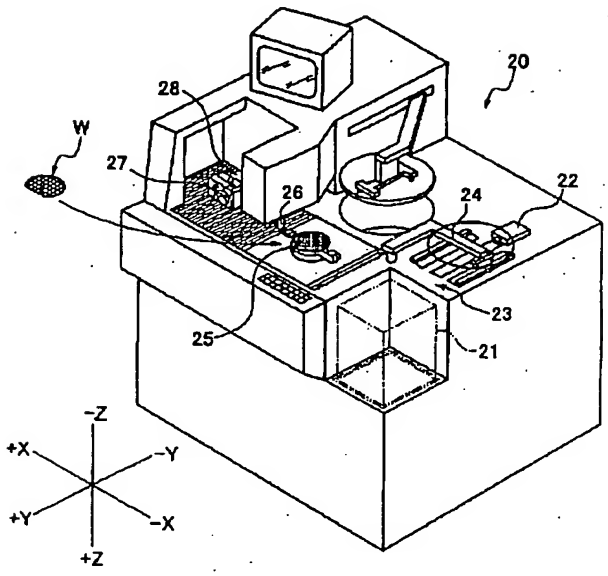
[Drawing 1]



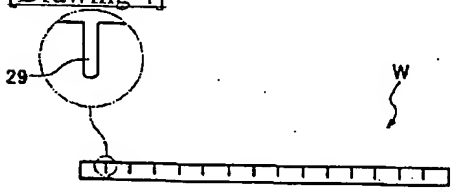
[Drawing 2]



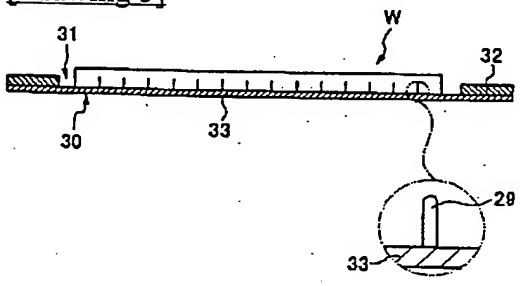
[Drawing 3]



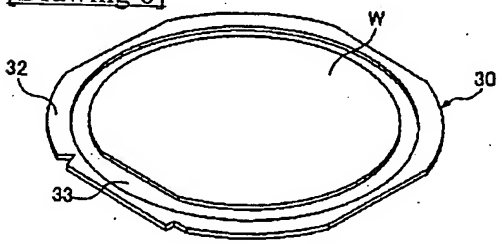
[Drawing 4]



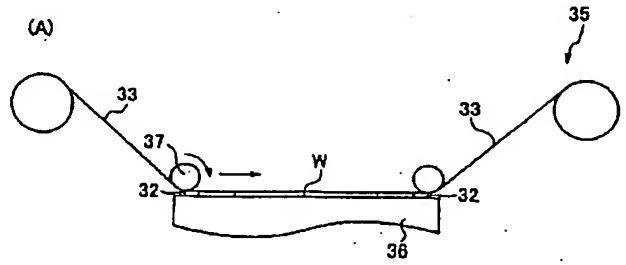
[Drawing 5]

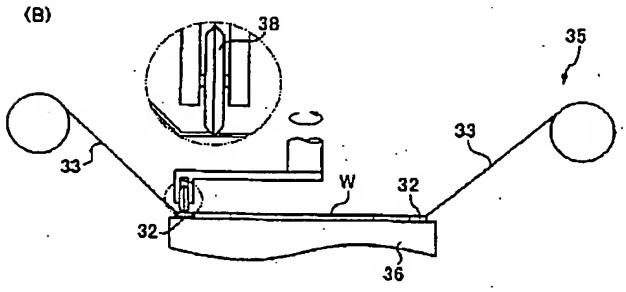


[Drawing 6]

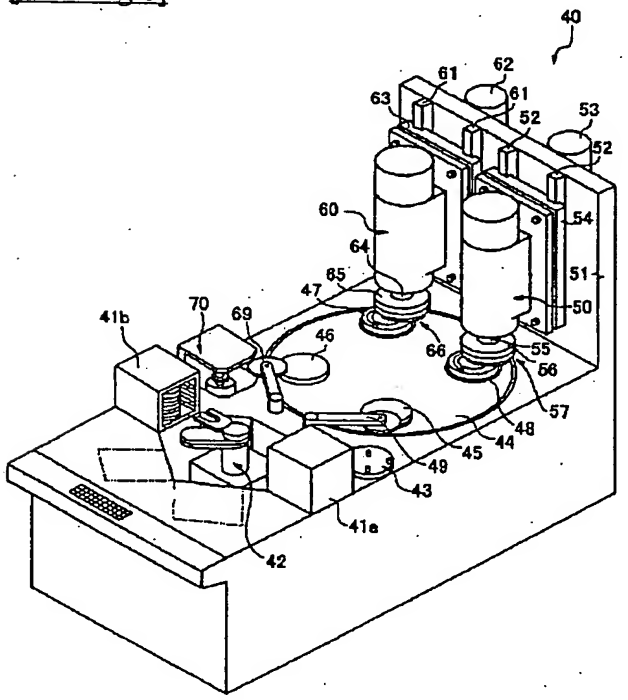


[Drawing 7]

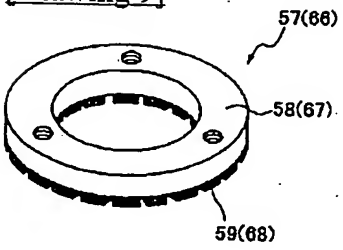




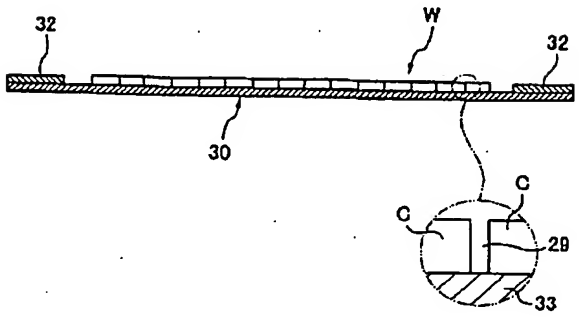
[Drawing 8]



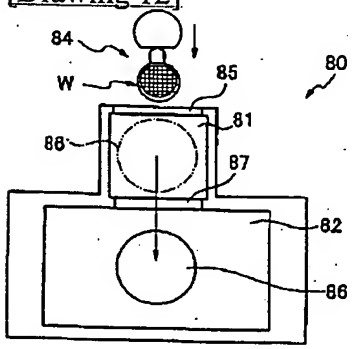
[Drawing 9]



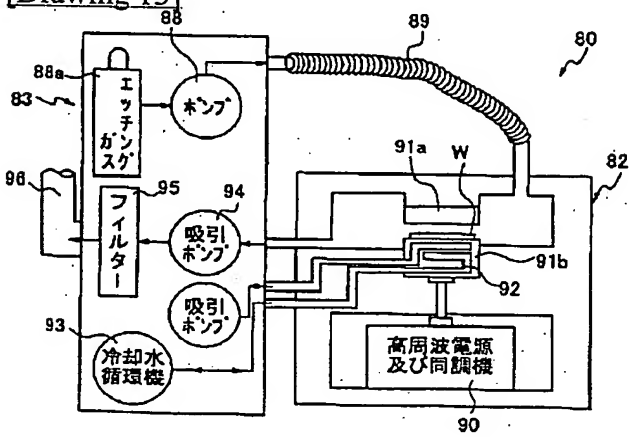
[Drawing 10]



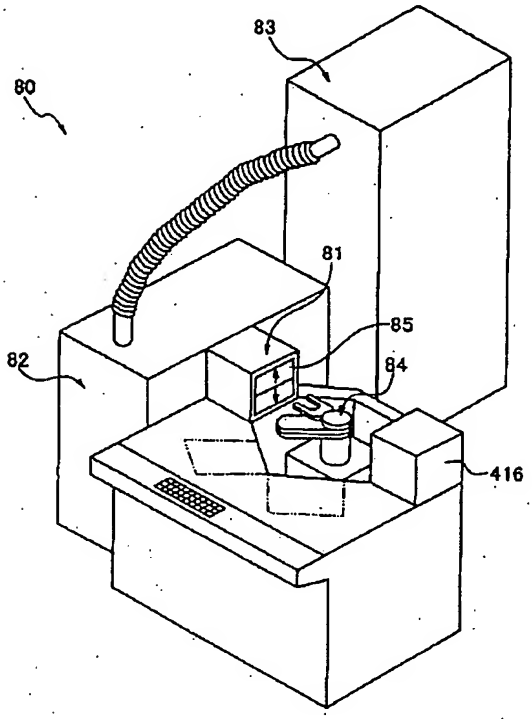
[Drawing 12]



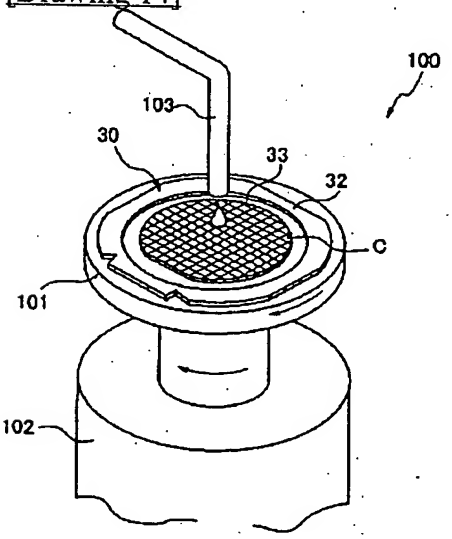
[Drawing 13]



[Drawing 11]



[Drawing 14]



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